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ENTERPRISE ARCHITECTURE AS A CONTRIBUTOR TO SUSTAINABILITY OBJECTIVES

Research in Progress

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Abstract

Sustainability goals as reflected in an organization's stated mission, should be supported by the Information Technology strategies and functions of the organization. Enterprise Architecture (EA) processes are intended to identify and create alignment between the organisational mission and information technology enabled activities. This exploratory research investigates the use of Enterprise Architecture at two large natural resource extraction organisations through a sustainability lens to reveal the IT contribution to the sustainability aspects of the organisational mission.

Keywords: IT organisational alignment, Enterprise Architecture, sustainability, natural resources

1 Introduction

The primary goal of Enterprise Architecture (EA) is to align the business mission with the organisations Information Technology (IT) capabilities (Zachman, 1999). There is increasing recognition that 'business as usual' is not sustainable and that a broader arena of concern is necessary to reduce negative impacts on the environment, social well-being of employees and on the neighbourhoods surrounding large scale industrial activity (Richardson & Henriques, 2004). EA provides processes through which organisations can align IT capabilities with sustainability goals. To date little research has been conducted on the impact of EA initiatives on the achievement of sustainability objectives. Considering the written mission statement of the organisation and the alignment of IT with that mission, this paper considers IT's mission alignment through the sustainability lens to determine if IT contributes, detracts or is an irrelevant force for effecting the organisations sustainability agenda (Box, 2002; Chen, 2008).

The natural resources sector has been viewed as the iconic instantiation of a society that degrades the physical and social environment of the many to achieve economic prosperity for the few. Cases such as the Deepwater Horizon Oil Rig disaster in the Gulf of Mexico in 2010 (Talhami, Esmail, & Eargle 2012) highlight that even when expensive and damaging accidents occur, ecological and social impacts are dwarfed by the firms' extraordinary profits over the long term. Indeed, firms considered to have poor corporate performance regarding environmental and social factors tend to experience better returns than firms more aligned with the societal good (Brammer, Brooks, & Pavelin, 2006). In the US some 80 abandoned large mines and thousands of smaller abandoned mines have an estimated clean-up cost of \$32 - \$72 Billion USD (Finnie, Stuart, Gibson, & Zabriskie, 2009) yet the mining firms bear little of this financial responsibility and there are large environmental and social impacts on the

communities in which these mines are located. Examples such as these give credence to the perception that the resource extraction industries emphasise profits above all other concerns.

In reaction, natural resource extraction firms have increasingly focused on their environmental impact and reputation (Giurco & Cooper, 2012). This change reflects the shift in community expectations that companies must attend to sustainability including the long term effects of the business on local people, the environment and regional social dynamics. Economics have always played a pivotal role in these organisations, but a shift to maintaining positive economic, environmental and social outcomes for the long term is an evolving trend (Finnie et al., 2009; Tverdak-Slattery, 2012). Organisational documents such as annual reports and press releases publicly present a view that sustainability is a large part of their organisation's agenda. For example, a large natural resources firm we refer to as Company X defines sustainability as the first of their seven values in their charter. (Company_X, 2012)

Enterprise Architecture (EA) initiatives are intended to align IT strategies and functions with business mission and values, and this research explores the question, are enterprise-level architecture initiatives driving, contributing to, or detracting from the organisation's sustainability objectives? As the resource extraction sector has a large environmental footprint, a secondary question emerges, which asks, how can EA actions supporting sustainability outcomes be transferred to organisations desiring to increase sustainability initiatives? Through a sustainability lens, this case study explores what happens at the grass roots, in real natural resource extraction firms and how IT contributes to desired outcomes for environmental, social and economic sustainability.

2 Prior Research: Enterprise - IT alignment

The alignment of Information Technology (IT) with the mission and goals of the enterprise is of increasing interest. Numerous frameworks including Luftman's strategic alignment model (Luftman, 2003), The Open Group Architectural Framework (The Open Group, 2011), COBIT (ISACA, 2012) including VAL IT (ISACA, 2006) and the Zachman Framework are used by organisations to drive change and increase alignment. The central idea is that the alignment is situated along a dimension anchored at one end by business concerns and strategy and anchored at the other end by IT capabilities and strategy. Thus the enterprise may be predominately business directed – IT must do this and this way, to predominately IT directed – IT will allow the business to do only this. The desirable alignment is a middle position in which IT can inform the business strategy and both IT and business enable strategy execution collaboratively (e.g. IT has these specific capabilities; if the organisation focuses in this area new opportunities can be realised)

The organisational performance field provides evidence that organisational outcomes are improved when IT and the organisation is aligned (Henderson & Venkatraman, 1993). In the field of organisational alignment, research demonstrates that increased vertical alignment (alignment of organisational hierarchies) and horizontal alignment (alignment of the disparate organisational departments and functions) improve outcomes for organisations relative to the mission (Nadler & Tushman, 1988; Quiros, 2009). IT is not an island in a sea of disparate organisational components, rather there is horizontal congruence between IT and management of the organisation as a whole (Quiros, 2009). A common theme of horizontal integration is linking the organisation's departments by providing common tooling and master data management across the functions to provide integration, standardisation and simplification (Semler, 1997).

An organisation invests resources and conducts activities in order to fulfil a defined mission. The mission is a set of high level objectives that the organisation exists to achieve. Incorporating principles within the mission, organisations define the way in which it will operate to realise these objectives. The alignment of the organisation's mission and the various segments within demonstrates how relevant the mission is to the unwritten or actual objectives and values being effected by the organisation. Where there is misalignment this may be symptomatic of poor organisational mission

inculcation by management and a lack of engagement within the organisation generally. Most current mission statements contain references to sustainability (Taticchi, Carbone, & Albino, 2013).

2.1 Sustainability considerations

Recent IS literature has recognized that sustainability encompasses environmental and social concerns in addition to economic viability. These concerns are reflected in frameworks such as the Triple Bottom Line (Richardson & Henriques, 2004), eco-strategies such as eco-efficiency, eco-equity and eco-effectiveness (Jenkin, Webster, & McShane, 2011), IT-enabled business transformation (Elliot, 2011) and energy informatics (Watson, Boudreau, & Chen, 2010). For the purpose of this exploratory research we focus on sustainability as composed of three aspects: Environmental, Economic, and Social (Richardson & Henriques, 2004).

3 Research Setting

The lead author is a senior IT Architecture consultant and Open Group Master IT Architect with seven years' experience at a major IT vendor. His current clients include large global natural resources companies with IT operations located in, Singapore, USA, India, Australia, Canada, Africa and South America. The natural resources industry supports other industries by supplying raw materials that are refined and manufactured into the everyday goods our society uses (Tverdak-Slattey, 2012). The lead author's professional assignments during the research period facilitated access to senior business and IT staff within or providing services to the target organisations. The interviewees recalled experiences related to their current and previous engagements, broadening the organisations represented. To anonymize the organisations involved as a condition of the interviews, all organisations are referred to generically and the informants are referred to only by title. During the 10 year period prior to this research, the informants consulted maintained extensive experience in designing IT architecture or supplying IT services to three natural resources firms. This research focused on their activities from 2009-2013.

The firms considered in the research did not use specific EA frameworks explicitly, rather internal, proprietary EA frameworks were used that were informed by widely used defacto EA standards. The iterative process embedded in EA approaches such as TOGAF ADM (The Open Group, 2011), Zachman (1999), and IBM's UMF (Zimmermann, Kopp, & Pappe, 2009) allows for the identification and integration of current organisational and IT strategy themes. Sustainability is now a credible and required dimension for organisations to adopt and inculcate in all aspects of their operations.

3.1 Data Collection and analysis

We conducted semi-structured interviews with six high level business managers and IT professionals currently working in the natural resources sector. Interviews focused on the informants' knowledge of the business mission statement, business processes, how decisions were made, and how IT presented itself in sustainability objectives. The interviews were recorded while additional observations were noted at the time of the interview. We followed the guidance of Golden (1992) in using multiple knowledgeable informants, asking for recall of concrete events, ensuring confidentiality and minimizing duration and inconvenience. In addition, corporate sustainability mission statements were examined and interviews were subsequently discussed and themes extracted.

The findings are limited by the small number of informants. One purpose of these exploratory interviews was to refine the protocol prior to expanding the breadth and scope of interviews. These preliminary findings serve to set the context for continued work.

4 Findings

Most of the interviewees commanded some knowledge of the strategic organisational statements but when questioned on the sustainability elements within the statement the common responses were themed around safety with very limited discussion of broader sustainability elements. The mission statement, states; “Sustainability – Putting health and safety first, being environmentally responsible and supporting our communities” and “...we are successful when...our asset portfolio is world class and sustainably developed” (Company_X, 2012). Similarly, the 2012 annual report at Company Y dedicated seven pages of detail regarding sustainability including; “At [Company Y], sustainable development is integrated into everything we do. Our operations give us the opportunity to bring shared value to the communities, regions and countries in which we work.” (Company_Y, 2012)

In general there was poor awareness of the sustainability vision from an architectural perspective and little alignment thinking. The stakeholders involved provided answers such as, “The IT department is simply an enabler of the business vision”. (Interview: Company X, Manager Planning and Projects) This utility paradigm of IT was ubiquitous throughout the interviews conducted. A further example was volunteered by a Director of IT Operations as “In the end we [IT] is more of an electricity department than a marketing department we just need to provide those behind the scenes services, if no one hears from IT then we are doing a good job, IT do the best they can to translate of what the business requires, but it’s always a loose translation.” IT was used to support many point-solutions but these were typically oriented towards regulatory compliance rather than broader sustainability awareness and action. For example, a Manager, Planning and Projects commented that “The SAP environmental compliance project was an example of how IT was an enabler for a sustainability initiative but this was primarily to measure compliance to regulation”. The technology was selected in alignment with current legal frameworks, not the organisational sustainability mission. One sustainability area that was embedded in IT architectures and processes was a concern for safety. This was observed in all discussions as evidenced by the interviewees’ ability to recite the safety elements of the mission statements and the way safety was volunteered immediately when the sustainability questions were posed. “Company Z takes safety very seriously and as key aspect in everything we do.” (Director of IT Operations)

4.1 Key Thematic Findings

Abstracting key EA stages from specific EA frameworks such as TOAGF and Zachman (Zachman, 1999), the authors present below high level EA principles and the themes observed during the interviews relating to each principle (Table 1).

| EA Principles | Themes in Interviews | Representative Comment |
|--------------------------------------|---|---|
| Architectural Vision | There is no single well known definition in use at natural resources firms for the term sustainability | “...I’m still learning about what sustainability is” |
| Business Mission/IT alignment | The vision or mission is formed by senior management and does not typically involve IT managers | “[The CEO] had a very clear agenda and mission of simplicity and that propagated throughout the organisation with IT having a key part to play...there is a clear separation of the business and IT.” |
| IT Function | IT is a utility seen as a provider of fundamental services needed to enable the core resource extraction activities | “IT can operate at different levels within the organisation, so it depends what level is engaged to define the utility perception.” |

| | | |
|-------------------------------|--|--|
| IT Transition Planning | Frameworks for designing, implementing and measuring value are in infancy and not widely understood at the practical implementation of IT projects and management in these companies | “We use project management processes but IT Architecture as a process is not really enforced.” |
| IT Governance | In the EA Approval Boards, sustainability was not explicitly discussed. The only exception was safety. | “Safety is one of the foremost things, part of their culture.” |

Table 1: Key thematic findings

We visualize the findings by overlaying a generic EA process, informed by TOGAF and Zachman (The Open Group, 2011; Zachman, 1999) with the observed sustainability considerations (Figure 1).

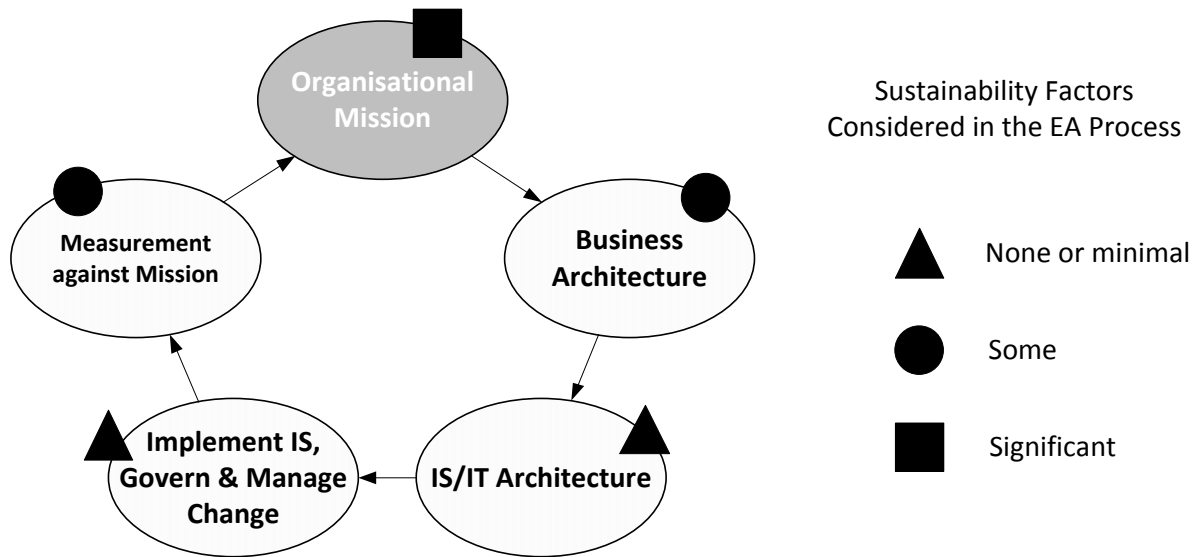


Figure 1. Simplified, generic EA process overlaid with sustainability considerations

The key observation from this EA analysis is that sustainability was not explicitly considered during IS Architecture development. The EA framework itself is not at fault, rather the explicit application of the sustainability lens to align IT strategy and functions with organizational sustainability goals remains an untapped opportunity.

4.2 Discussion: Advancing sustainability objectives through Enterprise Architecture

Viewing EA alignment through the sustainability lens, it was evident from the data that whilst the senior management direction of the organisations was focussed on sustainability on paper, the vertical integration of the sustainability agenda dissipated as the message filtered to lower levels of the organisational hierarchy. The data indicate that because IT is viewed primarily as a utility analogous to electricity supply, IT provided little value that specifically advanced the sustainability objectives articulated in the firm's mission statement. This suggests that information technologies are unaligned and underutilised for achieving sustainability goals. Given the senior roles of the informants, it was surprising that environmental and social sustainability aspects were not part of the alignment discourse. But the relative scarcity of sustainability representation in EA processes suggests opportunities for sustainability initiatives enabled by IT.

Drawing on prior literature and our own analysis opportunities include but are not limited to:

- Data informatics for energy consumption, waste monitoring and environmental audits
- Increase use of point-solution technologies such as energy informatics and embedding of those measures in reporting, planning and action
- Provision of social support
- Ecological reporting using industry collaboration and benchmarking
- Integrated sustainability planning to better manage project efficiently
- Staff training on sustainability using technology

4.3 Advancing sustainability through EA

This exploratory research suggests that IT in natural resources firms is an enabler of operational goals but is not leveraged to specifically contribute to the sustainability mission (Table 2). Although sustainability components appear in the firms' mission, there was general scepticism about the environmental and social aspects of sustainability and IT does not directly implement these. One exception is an emphasis on safety which fits in the human segment of sustainability; all firms examined practiced and measured the safety for humans of its operations.

| EA factor | Observed | Opportunity |
|--|---|---|
| Is IT aligned with the business? | Yes economic but not environment or social | Considering the organisations mission and its sustainability agenda, EA can better fulfil its role to the organisation if it is better informed by sustainability goals |
| Is the IT-Organisation sustainability alignment measured? | No | Using the alignment models organisations can improve sustainability practices and performance |
| Does IT inform the mission? | No | There is opportunity in the areas of data analytics, operational technology and IT -cross pollination to drive sustainability objectives |
| Considering EA frameworks as an example, is the perception style of IT Architecture development used to frame sustainability objectives where IT has a role? | No | EA approaches and thinking can increase the role of IT in achieving sustainability for the organisation as sustainability technologies, KPIs and management becomes embedded in the IT infrastructure and strategy. |
| Is sustainability a factor in IT in the firm? | Somewhat Safety was the key observation. | By inculcating sustainability in EA the firms stated sustainability agenda is propagated by IT |

Table 2. Opportunities for EA to embed sustainability in the organisation

Enterprise Architecture processes can provide alignment of an organisational sustainability agenda with specific IT initiatives. One opportunity revealed by this research to advance the organisation's sustainability agenda is to reduce duplication of technology resources and bridge the separation between the business operations systems and process control systems. Further, EA practitioners have opportunities to offer increased capability to align IT to the business sustainability mission (Table 2) in a customer and supplier model where currently very little sustainability value is presented back to the business by IT.

Additional research on EA and business/IT sustainability alignment would identify specific technology innovations which could transform sustainability practices in natural resources industries and guide practitioners in ways to accomplish these objectives. Although economic sustainability is

assumed, EA processes can substantively consider IT as a key contributor to environmental and social sustainability to achieve better outcomes for the organisation and society as a whole.

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